CLAIMS

1. An IFF transponder for ground applications, comprising:

- Encoder for forming an interrogating or response sequence of pulses, and conveying the same to a UWB transmitter;

A UWB transmitter for getting said interrogating or response sequence of pulses, forming a corresponding interrogating or response signal of a sequence of UWB pulses, and transmitting the same via a UWB transmitting antenna;

A plurality of UWB receiving antennas, disposed away one from the other, for receiving either an interrogating signal or a response signal sent by another transponder;

A decoder for getting from at least one of said UWB receiving antennas received signals, decoding the same, comparing the decoded signal with a bank of pre-stored signals, and determining whether a received signal is an interrogating or response signal; and

A processing unit for, upon receipt of a signal of response to an interrogation signal sent by the present transponder, calculating the location of the responding transponder by:

a. Determining the range *R* by the time delays between the interrogating and response signals;

b. Determining the direction vector to the responding transponder by evaluating the time differences between arrival of each response pulse to a plurality of receiving antennas; and

c. determining the identity of the responding transponder by checking the received sequence of UWB pulses, assuming that the sequence of each transponder is unique.

2. A transponder according to claim 1, wherein the determining of the range R to the responding transponder by performing:

$$\frac{\left[(T_r - T_s) - T_{proc}\right]c}{2} = R$$

wherein T_r is the time of receipt of the first pulse of the response signal at the present transponder, T_s is the time of transmitting the first pulse of the interrogation signal by the present transponder, T_{proc} is the duration required for the interrogated transponder to process the interrogation signal, until transmitting the response signal;
and the determining of the direction vector to the responding transponder made by by performing:

$$\cos\theta = \frac{c\Delta T}{d}$$

wherein ΔT indicates the time difference of receipt of a same response pulse at a first receiving antenna and at a second receiving antenna, c is the speed of light, d is the distance between the said two receiving antennas, and θ is the angle between the said direction vector and a line connecting said two receiving antennas

3. A transponder according to claim 1 comprising three receiving antennas that are disposed at tips of a triangle.

4. A transponder according to claim 3 for use by infantry soldier wherein the receiving antennas are disposed on the helmet of the soldier.

5. A transponder according to claim 4 wherein the receiving antennas are printed on the helmet.

6. A transponder according to claim 3 wherein the transmitting antenna being located at the center of the triangle.

7. A transponder according to claim 1 wherein the UWB transmitter and the transmitting antenna are formed by two cones, a charging circuitry for charging the cones, and a fast switch for discharging the cones in order to produce a UWB pulse.

8. A transponder according to claim 1, for use on a vehicle.

9. A transponder according to claim 8 comprising at least three receiving antennas and one transmitting antenna disposed at different locations on the vehicle.

10. A transponder according to claim 9 wherein the receiving antennas on the vehicle are omni-directional antennas.

11. A transponder according to claim 9 wherein the receiving antennas on the vehicle are directional antennas.

12. A transponder according to claim 9 wherein some of the receiving antennas on the vehicle are omni-directional antennas and some of the antennas are directional antennas, all arranged to cover the area of interest.

13. A transponder according to claim 1 having two modes of operations, an interrogating mode in which the transponder interrogates the identity, range, and azimuth of another transponder in the area of interest, and a

responding mode in which the apparatus respond to an interrogation issued by another transponder.

14. A transponder according to claim 1 wherein each receiver is adapted to receive pulses of responding signal that are above a predefined threshold level, a level which is above the noise level.

15. A method for determining by an interrogating transponder the azimuth to an interrogated transponder, comprising the steps of:

a. Providing within the interrogating transponder a transmitting antenna, and at least two receiving antennas, disposed away one from the other;

b. Transmitting by the interrogating transponder a coded interrogation signal, comprising a plurality of UWB pulses;

b. Receiving at the interrogated transponder the interrogating signal, producing a response UWB signal, and transmitting the same to the interrogated transponder;

c. Receiving by at least two receiving antennas within the interrogating transponder said response UWB signal, and calculating the direction to the interrogated transponder by evaluating the time differences between arrivals of each response pulse to a plurality of receiving antennas.

16. A method according to claim 15, wherein the direction determination is made by:

$$\cos\theta = \frac{c\Delta T}{d}$$

wherein ΔT indicates the time difference of receipt of one response pulse at a first receiving antenna and at a second receiving antenna, c is the speed of light, d is the